Forecasting at JTWC

Major Steve Gruber
JTWC Technique Development

For a PPT Version of this presentation

JTWC Operations

- Governed by USCOMPAC instruction 3140.1(series), tropical cyclone operations manual
  - Also sets special observation requirements for U. S. Military weather stations when a tropical passes within 150nm
- Manned with 30 military and civilian positions
  - 17 Air Force 13 Navy
- Air force provides reconnaissance and forecasters
- Navy provides facility, equipment and forecasters

Products

- Daily - Significant Weather Advisory
- Prewarning - Tropical Cyclone Formation Alert (TCFA)
- Warning
  - Warning message
  - Warning graphics
  - Prognostic reasoning message
- Limited distribution items
  - Forecast aids
  - Conference call

Watch Team

- 24/7
- TDO
  - O-3/O-4
- Sat Ops
  - E-5/E-6
- TDA
  - E-3/E-5

JTWC Forecast Process

0500 L Watch Turnover

Perform streamline analyses, look for suspect areas, review old data and previous forecasts, issue sig wx bulletin(s)

0745L Metcon

0800 L Start 1800 UTC Warning

1030 L Issue 1800 Z Warning

1200 L Metwatch

1400 L Start

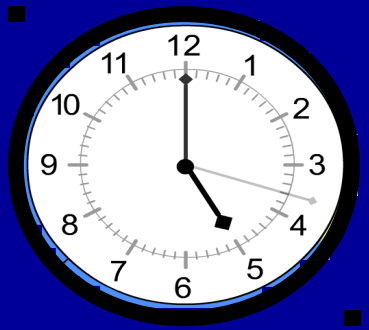
Over..2nd Cycle

A T C F

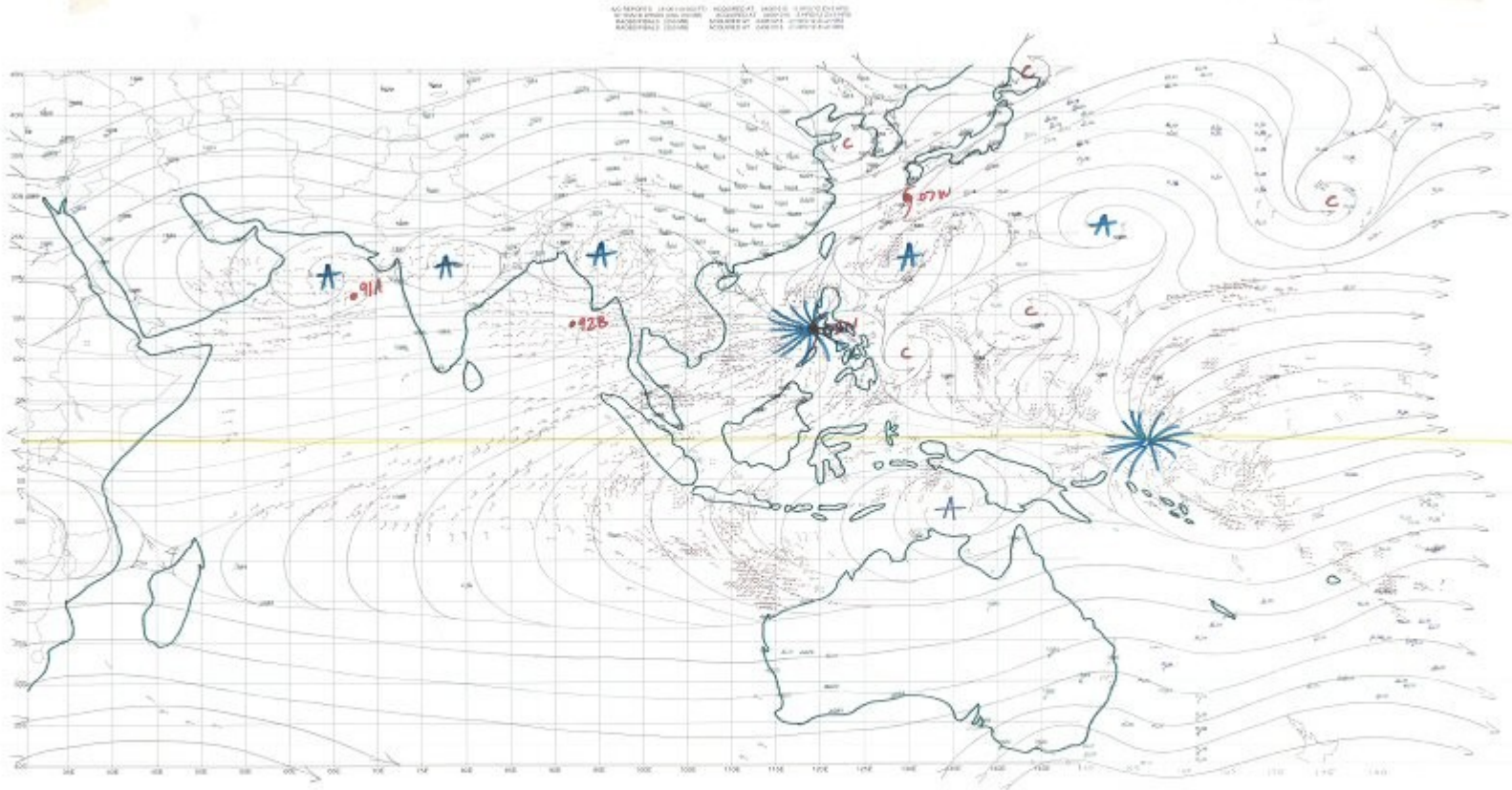
Warning Crunch

- Review fixes
- Update BT
- Send Bogus
- Create Consensus
- SAFA Analysis
- Intensity Assessment
- Wind Radii
- Create Warnings
- Issue Warnings x2 or x3
- 5 Day Aids
- Customer Calls
- Conference Calls

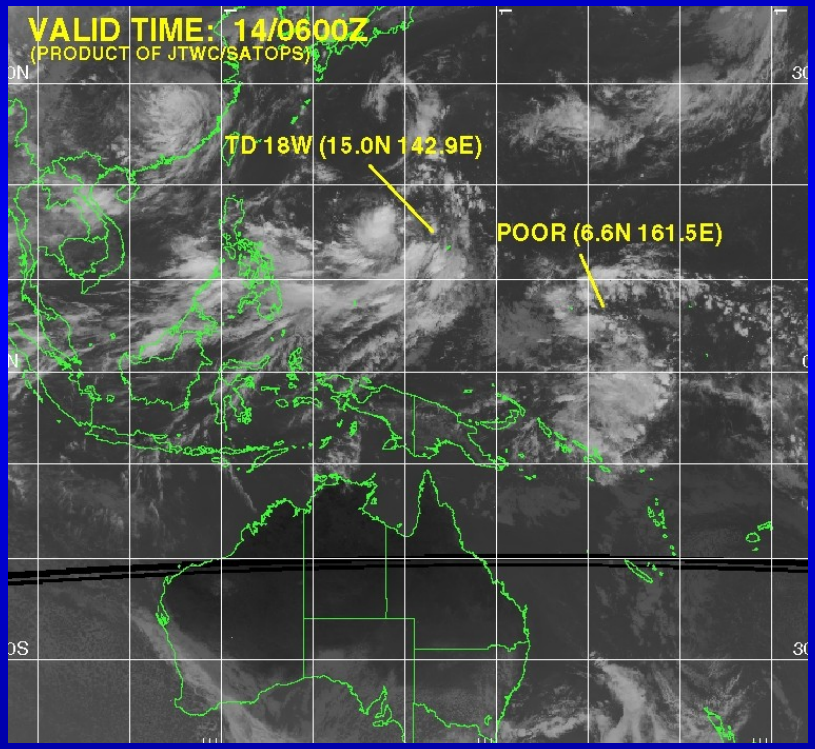
"TIME IS THE ENEMY"



Streamline Analysis Sfc & UA



Evaluate Suspect Areas/ABXX

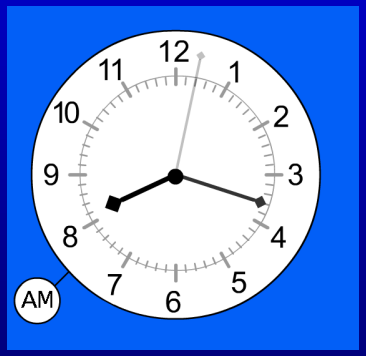


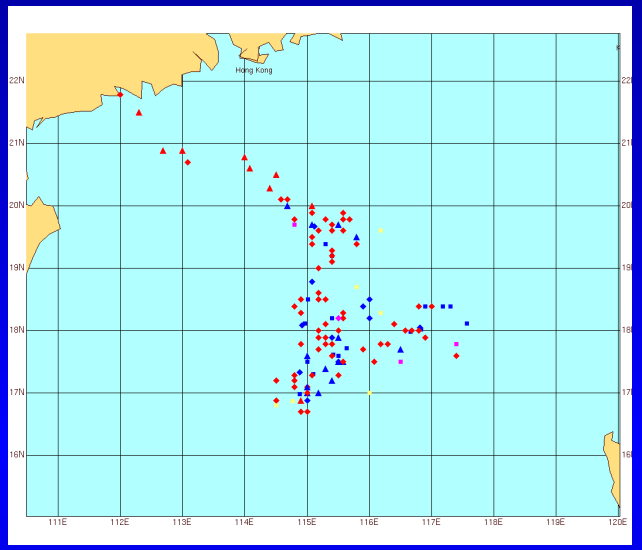

```
ABPW10 PGTW 140600
MSGID/GENADMIN/NAVPACMETOCCEN PEARL HARBOR HI/JTWC//
SUBJ/SIGNIFICANT TROPICAL WEATHER ADVISORY FOR THE WESTERN
/AND SOUTH PACIFIC OCEAN/140600Z-150600ZAUG2004//
REF/A/MSG/NAVPACMETOCCEN PEARL HARBOR HI/140151ZAUG2004//
AMPN/REF A IS A TROPICAL CYCLONE WARNING.//
RMKS/
1. WESTERN NORTH PACIFIC AREA (180 TO MALAY PENINSULA):
   A. TROPICAL CYCLONE SUMMARY:
      (1) AT 140000Z5, TROPICAL DEPRESSION (TD) 18W WAS LOCATED
NEAR 15.0N6 142.9E6, APPROXIMATELY 150 NM NORTHWEST OF GUAM,
HAS TRACKED WEST-NORTHWESTWARD AT 08 KNOTS OVER THE PAST 06 HOURS.
MAXIMUM SUSTAINED WINDS WERE ESTIMATED AT 25 KNOTS GUSTING TO 35
KNOTS. SEE REF A (WTPN31 PGTW 140300) FOR FURTHER DETAILS.
      (2) NO OTHER TROPICAL CYCLONES.
   B. TROPICAL DISTURBANCE SUMMARY:
      (1) THE AREA OF CONVECTION PREVIOUSLY LOCATED NEAR 14.5N0
144.5E4, IS NOW THE SUBJECT OF A TROPICAL DEPRESSION WARNING. SEE
PARA 1.A.(1) FOR DETAILS.
      (2) THE AREA OF CONVECTION PREVIOUSLY LOCATED NEAR 6.5N1 161.7E5
IS NOW LOCATED NEAR 6.6N2 161.5E2, APPROXIMATELY 200 NM EAST OF POHNPEI.
ANIMATED MULTISPECTRAL SATELLITE IMAGERY REVEALS INCREASING CONVECTION
IN ASSOCIATION WITH A POSSIBLE WEAK LOW LEVEL CIRCULATION CENTER. UPPER
LEVEL ANALYSIS INDICATES WEAK TO MODERATE VERTICAL WIND SHEAR AND
FAVORABLE DIVERGENCE. MAXIMUM SURFACE WINDS ARE ESTIMATED AT 10 TO
15 KNOTS. MINIMUM SEA LEVEL PRESSURE IS ESTIMATED TO BE NEAR 1008 MB.
THE POTENTIAL FOR THE DEVELOPMENT OF A SIGNIFICANT TROPICAL CYCLONE
WITHIN THE NEXT 24 HOURS REMAINS POOR.
      (3) NO OTHER SUSPECT AREAS.
2. SOUTH PACIFIC AREA (WEST COAST OF SOUTH AMERICA TO 135 EAST):
   A. TROPICAL CYCLONE SUMMARY: NONE.
   B. TROPICAL DISTURBANCE SUMMARY: NONE.
FORECAST TEAM: DIXON/BOWER/MENEBROKER/FUNK//
NNNN
```

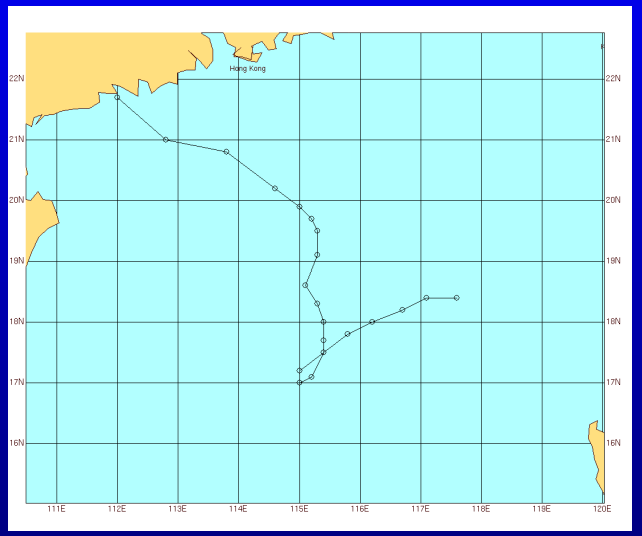
Best Track…Art or Science

- Best Track, Balance of:
  - Current Fixes
  - Smooth Storm Motion
  - Is it an Eye Wobble or not??
  - Microwave came in 3 hours later..50 nm off…
- “My forecasts were probably no better or worse than anyone else’s, but I always started in the best spot”

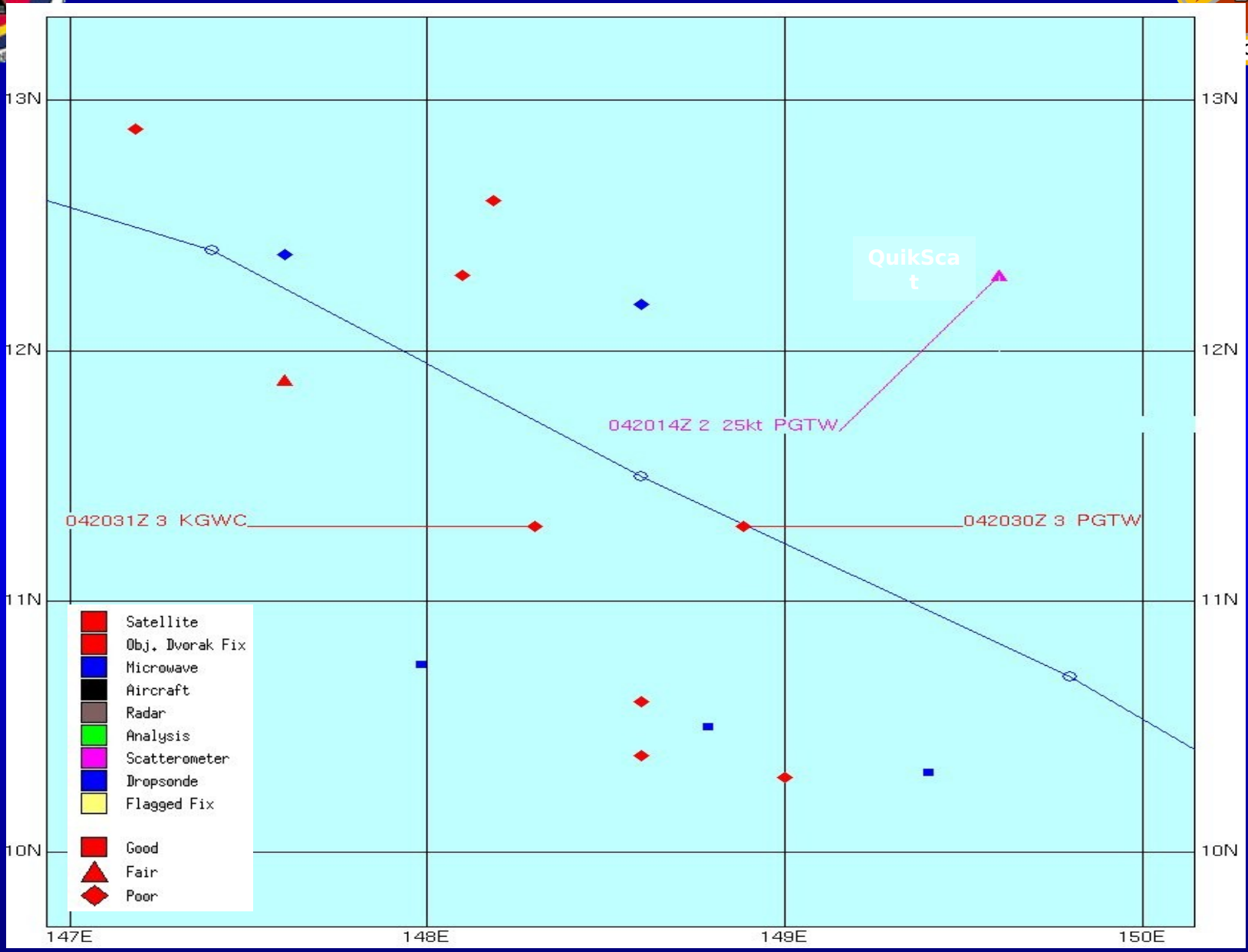
  Past TDO, 2004 MSCC

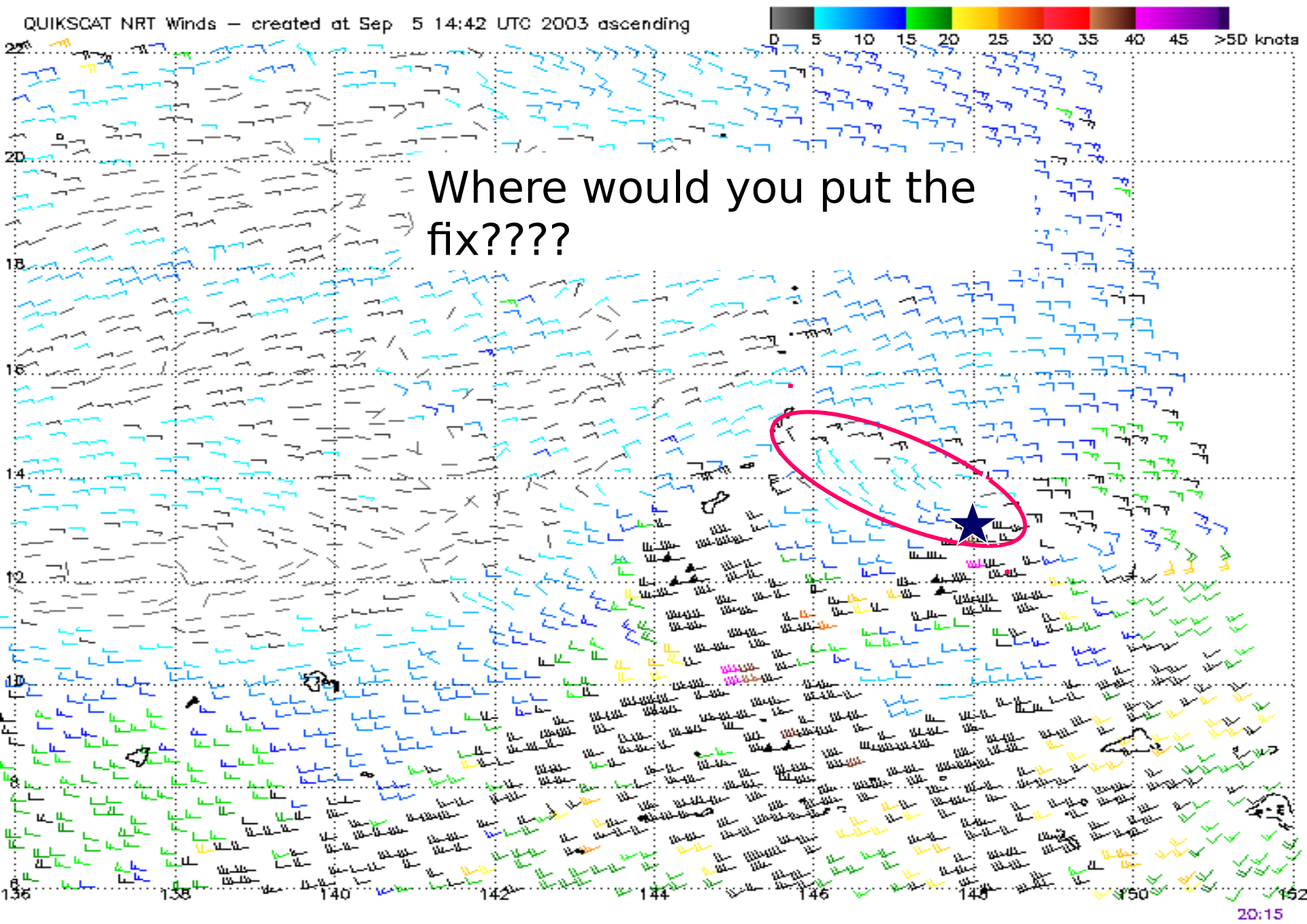




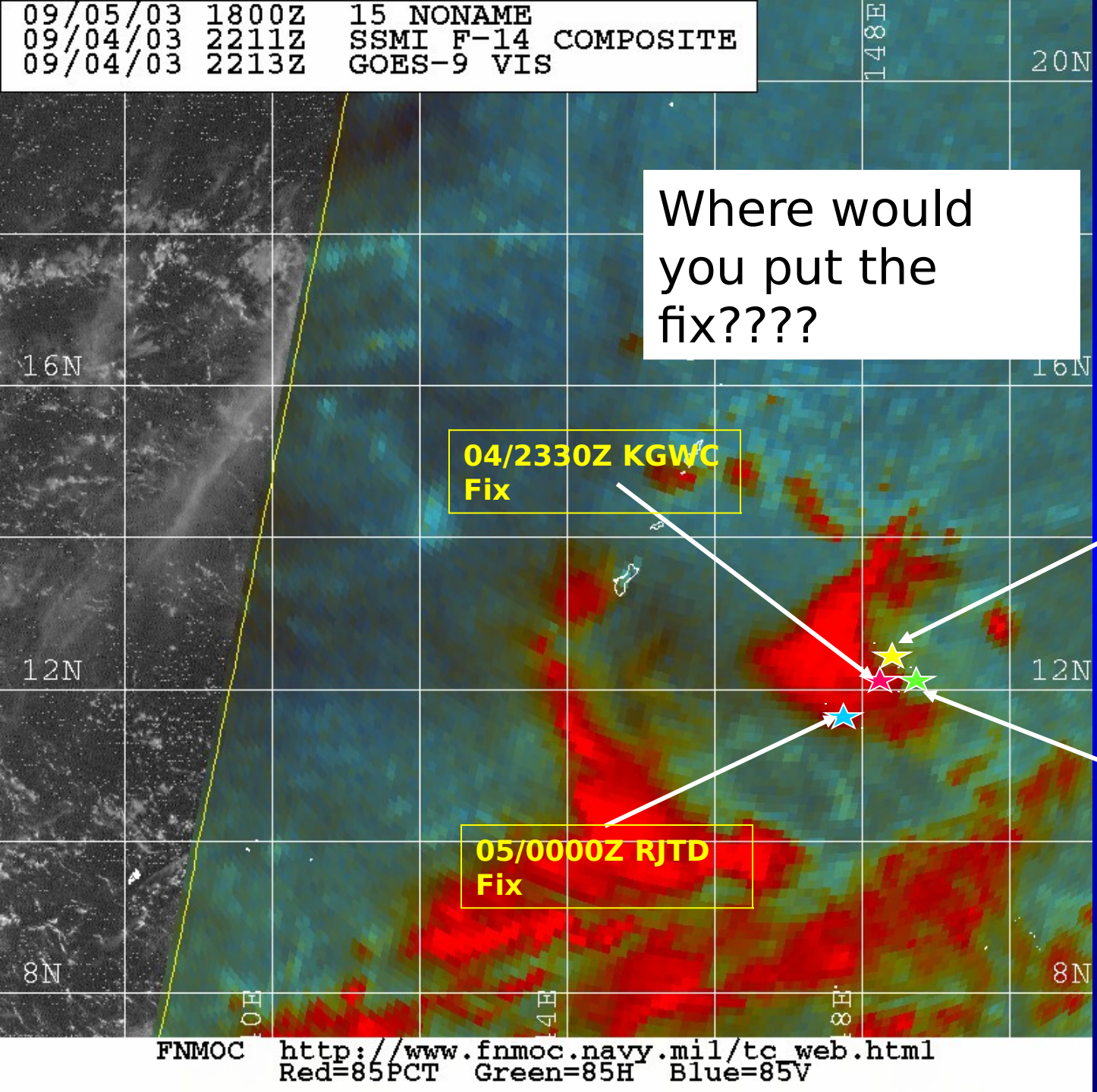


“It’s Not Always so Obvious”

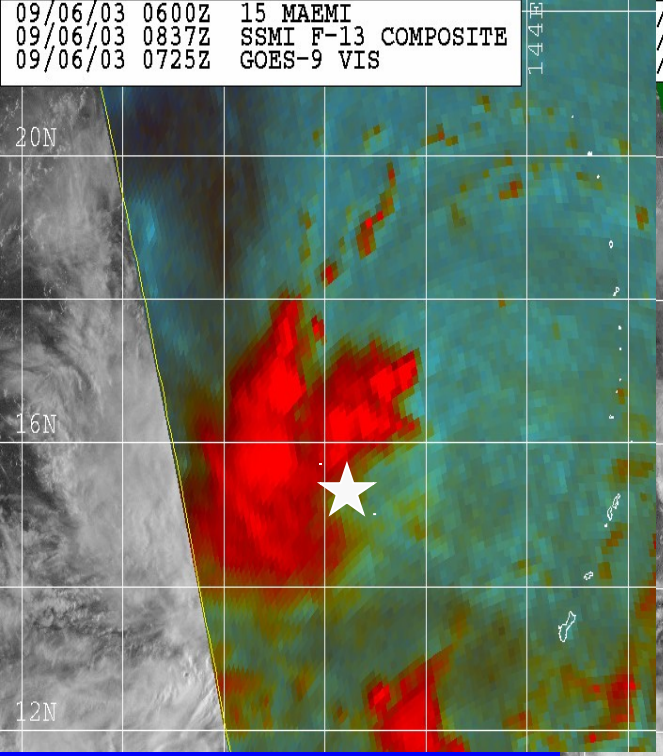


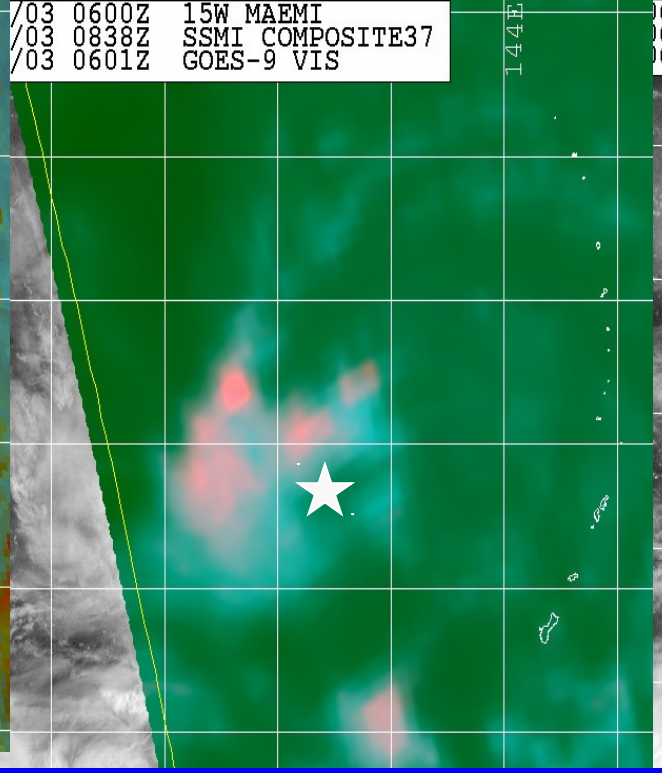


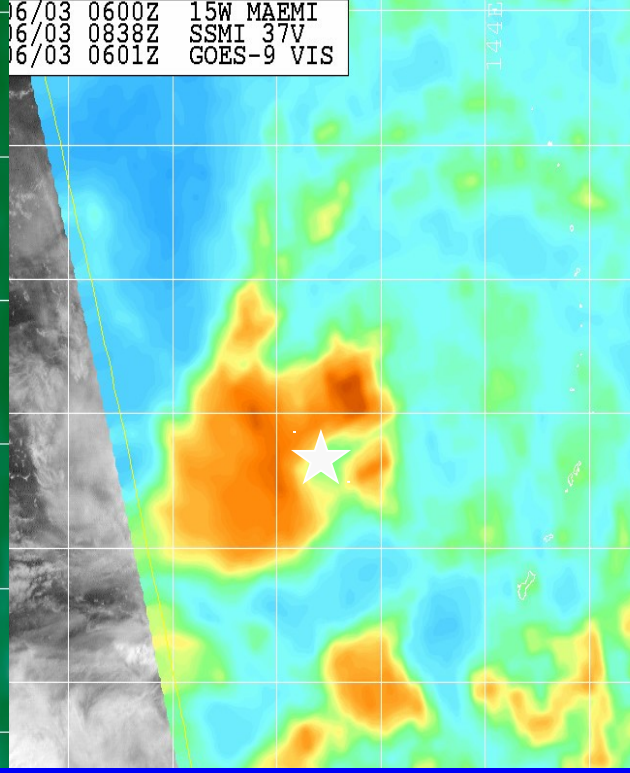
Storm number: 15 Storm name: NONAME
Note: 1) Times are GMT 2) Black barbs indicate possible rain contamination
3) Data buffer is Sep 5 14:42 UTC 2003—22 hrs 4) Data pass times at bottom of image


09/05/03 1800Z 15 NONAME
09/04/03 2211Z SSMI F-14 COMPOSITE
09/04/03 2213Z GOES-9 VIS
148E
20N
16N
12N
8N
Where would you put the fix????
04/2330Z KGWC Fix
04/ 2330Z PGTW Fix
04/2211Z SSMI Fix
05/0000Z RJTD Fix
FNMOC http://www.fnmoc.navy.mil/tc_web.html
Red=85PCT Green=85H Blue=85V

17 OWS







SSMI 85GHz Composite

SSMI 37 GHz Composite

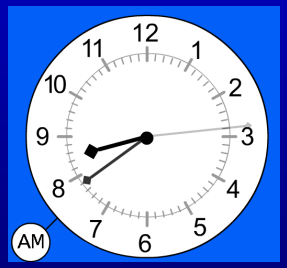
SSMI 37 GHz Vertical

Where would you fix at??

Did it come in on time to make a difference??

Bogus

- Bogus sent for Suspect Areas classified as a Fair or higher
- Need to evaluate:
  - Vmax
  - Rmax
  - Depth
  - ROMCI
  - 35 kt Wind Radii
  - 50 kt Wind Radii



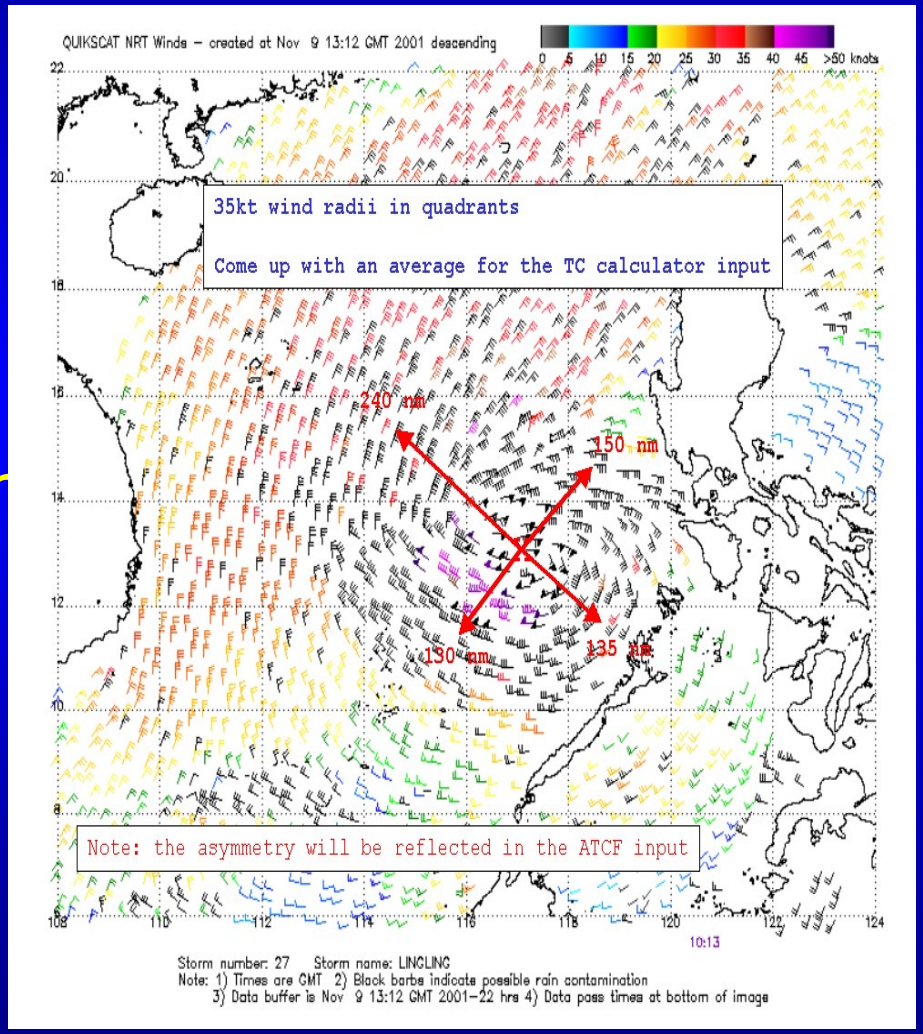
Log = atcf.boguslog

Log New Event
ATCF Support

		by: LT Wingeart/LTJG Roberts
1332	07/21/2002 04:31 Z	**21/06Z Bogus** NAME VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT 12W 140 20 D 1005 120 145NE/120/85SW 80E/75W 14W 40 30 M 1006 110 60NE/50NW/40S -- 13W 30 40 S 1006 120 -- -- *by: LT Wingeart/LTJG Roberts*
1331	07/21/2002 00:23 Z	**21/00Z Bogus** NAME VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT 12W 140 20 D 1005 120 145NE/120/85SW 80E/75W 14W 35 40 S 1008 90 -- -- 15W 30 40 M 1009 120 -- -- 13W 35 40 S 1006 120 -- -- *by: leejoice*
1330	07/20/2002 17:48 Z	**20/18Z Bogus** NAME VMAX RMAX DEPTH OMCI ROMCI 35KT 50KT 12W 140 20 D 1005 120 145NE/120/85SW 80E/75W 13W 35 40 S 1006 120 -- -- 14W 30 40 S 1008 90 -- -- 15W 35 40 M 1009 120 130SE/130NE/100W -- *by: leejoicer*

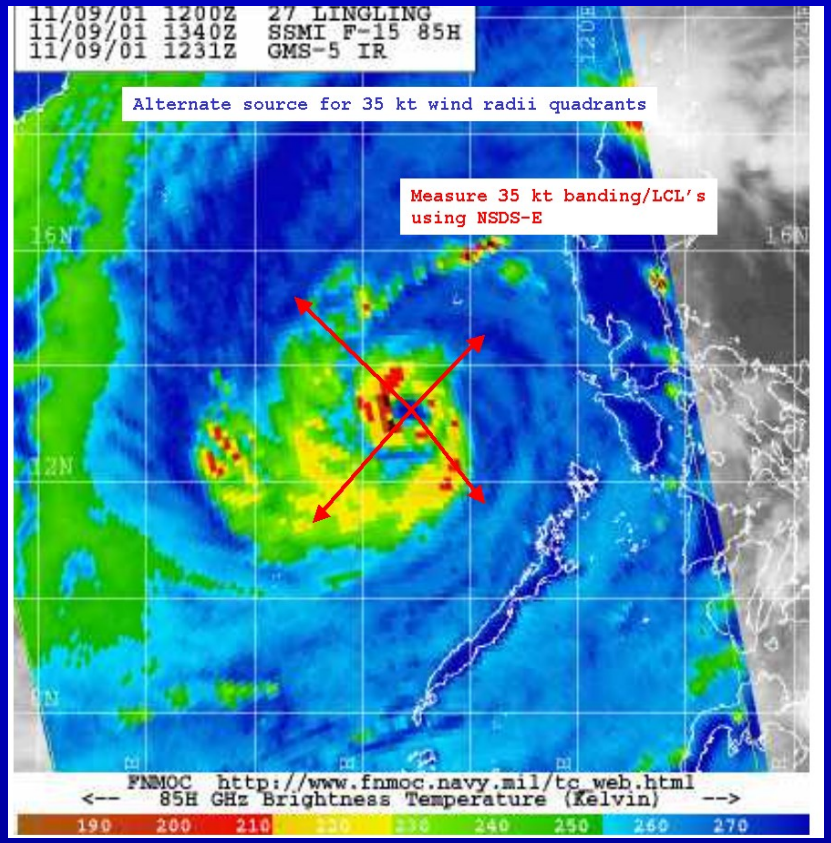
Determining Wind Radii Using Quikscat

- Many different ways to determine parameters
- Using Quikscat for TC 27 W



Determining Wind Radii using Microwave

- Using 85 GHz Microwave for determining the Bogus for TC 27W
- Validates TDO radii

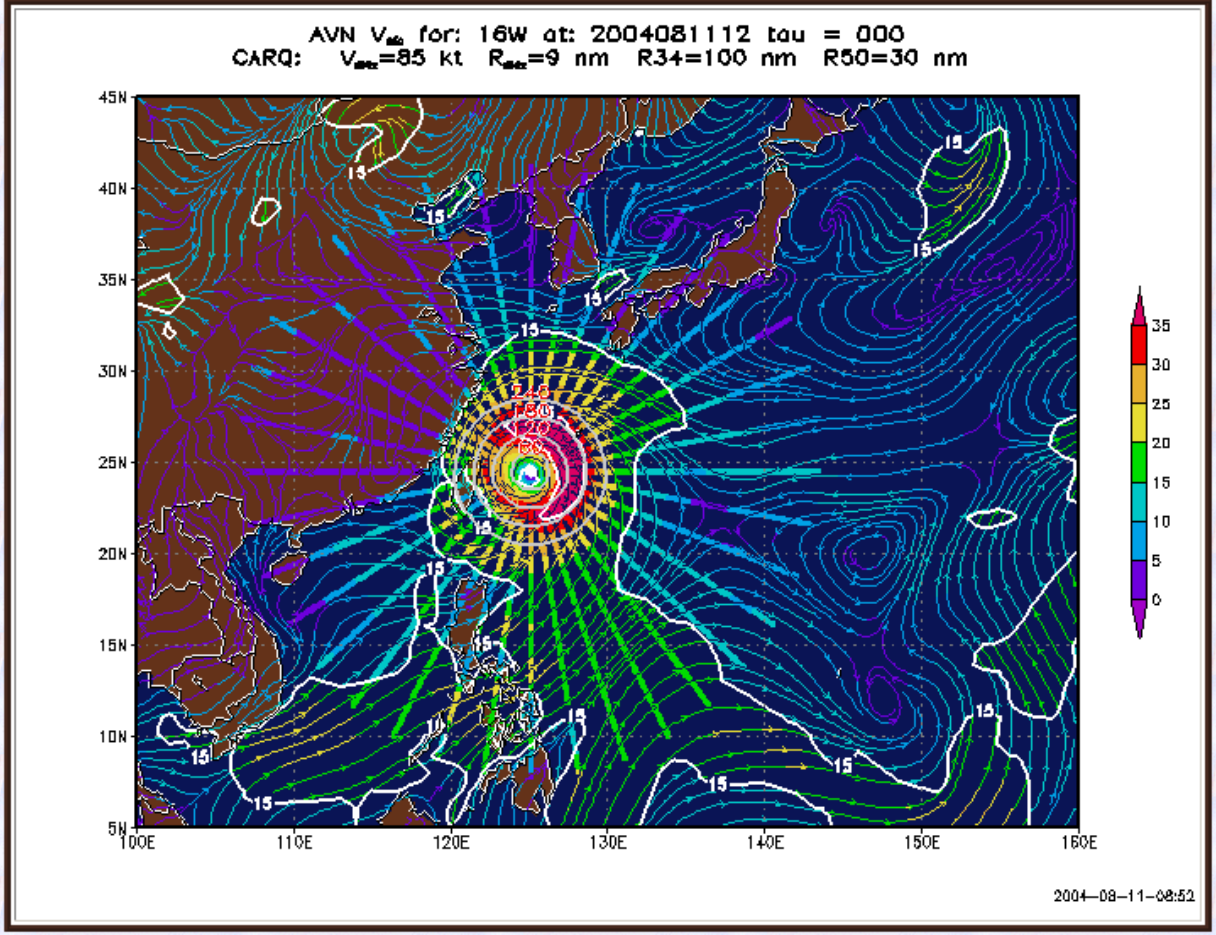


WxMap (NOGAPS, AVN and UKMO)

2004081218 | 2004081212 | 2004081206 | 2004081200 | 2004081118 | 2004081112

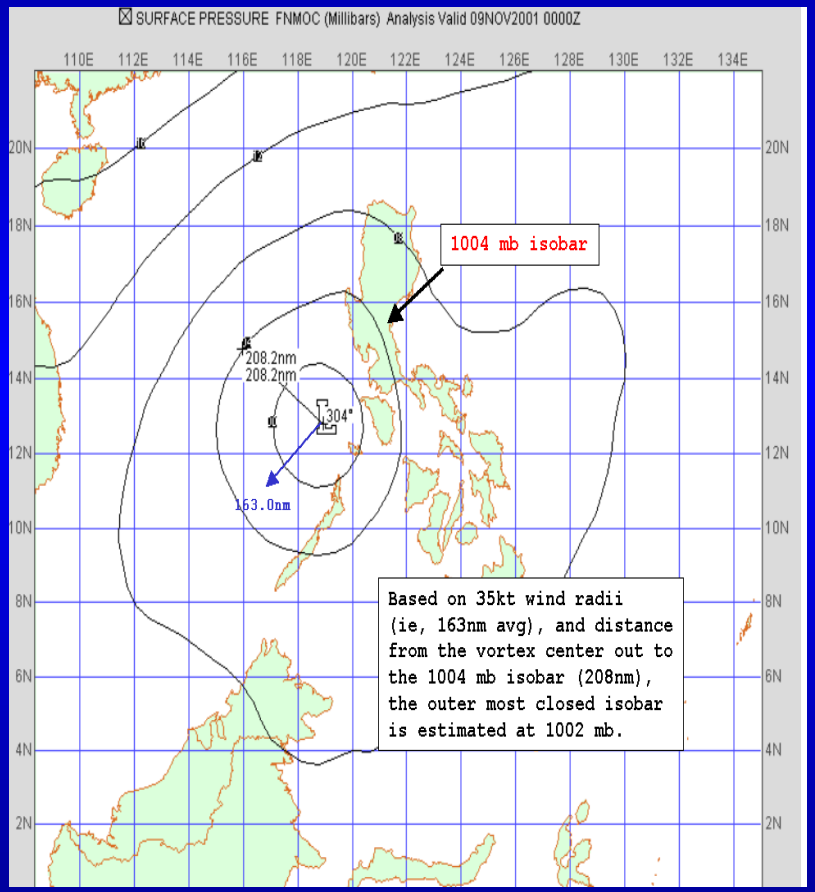
16W | 17W | 91W | 96E

AVN | NGP | 000 | 024 | 048 | 072 | animate | profile



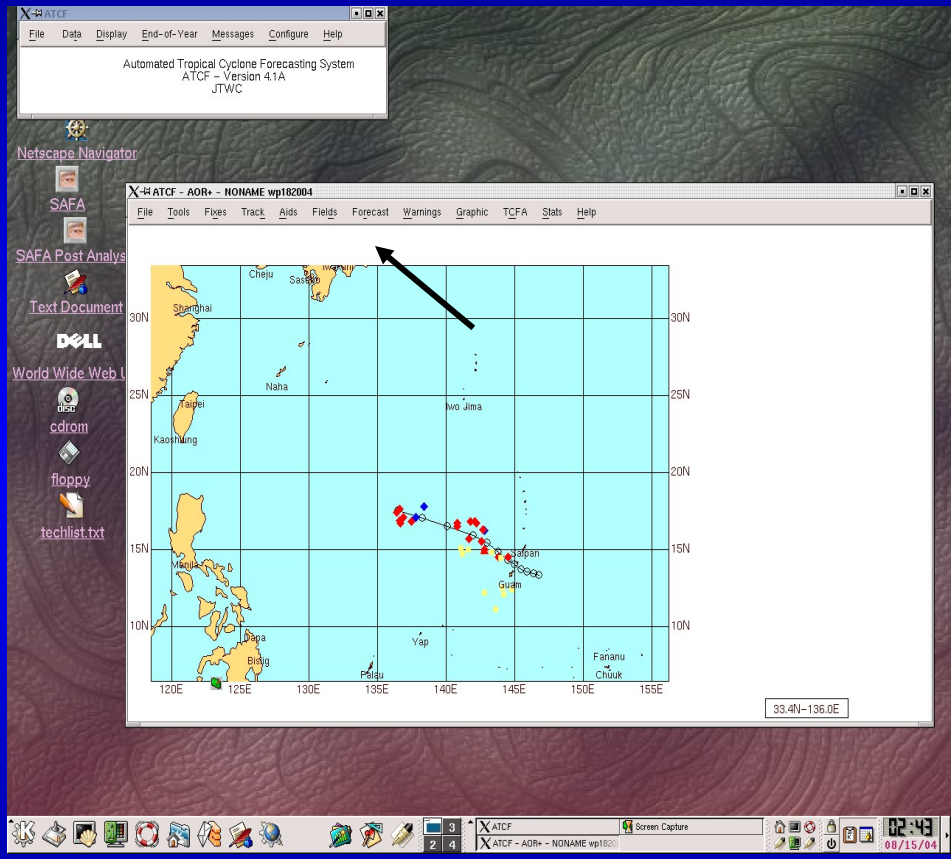
Determining the ROMCI

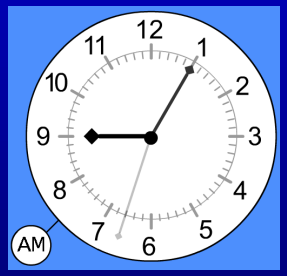
- Using Sfc MSLP Analysis to Determine ROMCI



Time to Forecast

- System has been:
  - Fixed
  - Rebested
  - Bogused
- Time to warn
- Need to:
  - Get Objective Aid Fields
  - Run Objective Aid Fields
    - Trackers Translated to Best Track
    - CONs are computed
    - Output sent to SAFA
- SAFA analysis/discussion





Systematic Approach to Forecasting (SAFA)

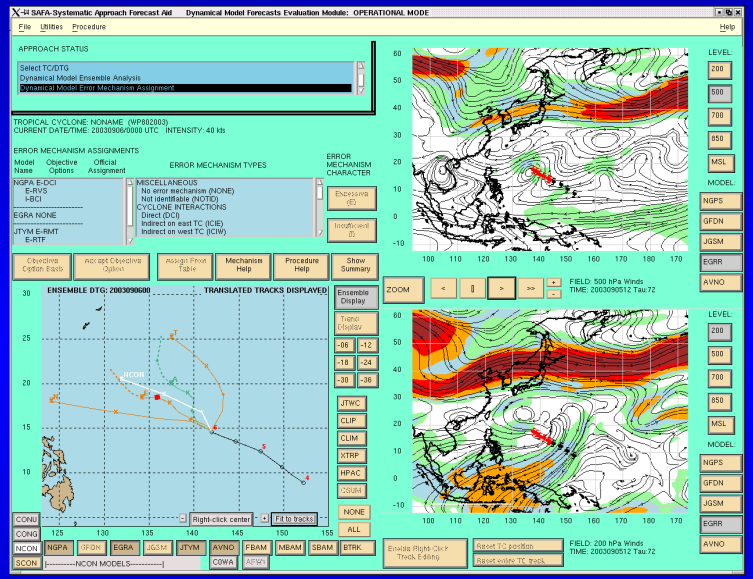
Systematic Training For Intensity Forecasting

Model Guidance
- Principles of TC motion
- Patterns and region classifications
- Use of imagery to understand the environment
- Transfer of knowledge
- Standardization of forecast process.

Consensus
- Consensus is first guess for all forecasts.
- TC's <55 kts and undergoing ET are problems for consensus.

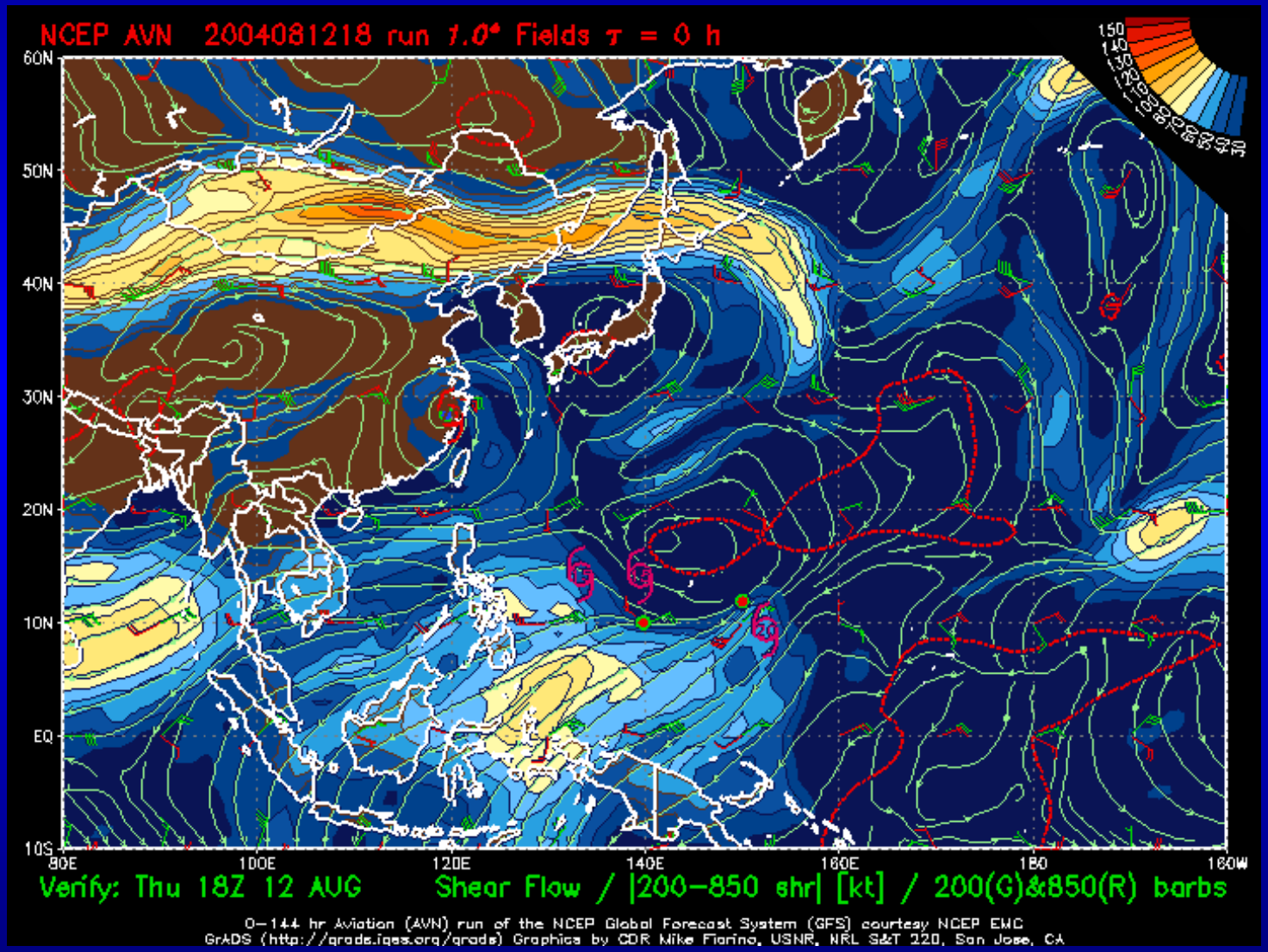
Rules of Engagement
- Make sure all possible CONW members are entered.
- If spread is large review and understand all model predictions
- Don't dismiss model predictions unless freq error mechanism is present.
- Position the JTWC 72h posit within 120 nm of CONW unless approved by JTOPS.

Problems
- Frequent Error Mechanisms are no longer evident in fields.
- Continuous changes in consensus make individual model tendencies too hard to manage.
- Need to look at situations where consensus typically fails (>225nm error) to update TDO training



- Use of imagery to understand the environment
- Standardizes the JTWC forecast process
- Model comparisons, current synoptic regime, current and future outflow, current and future wind shear

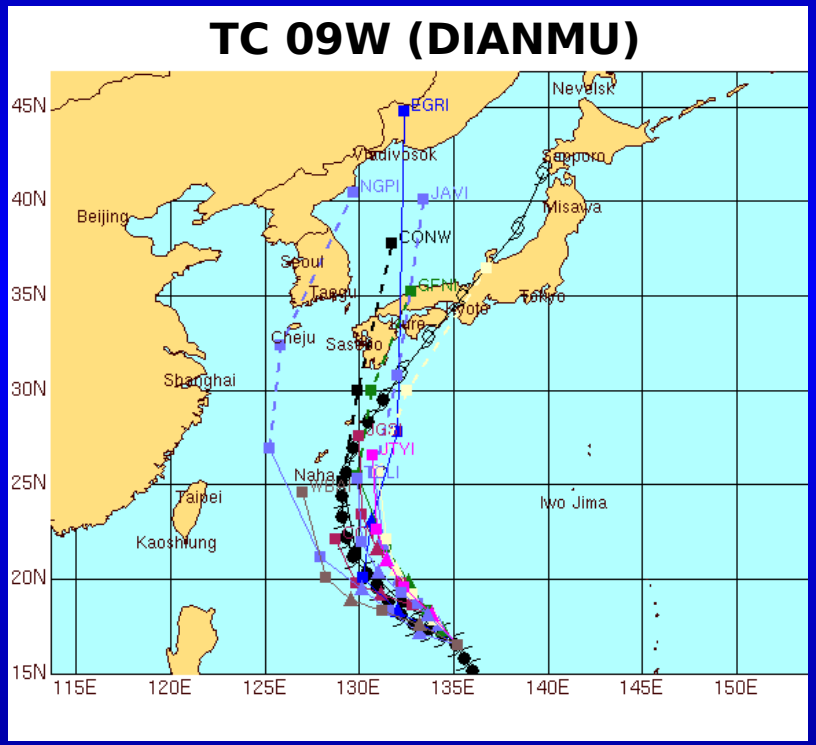
WxMap (NOGAPS, AVN and UKMO)

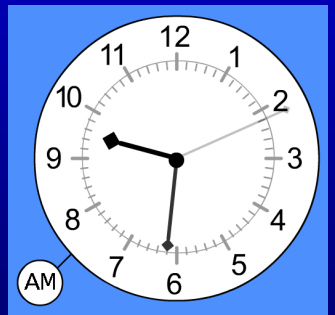


Forecasting The Track

- Currently utilize a Consensus of Dynamic Models
- CONW is the starting point
- Adjustments made after SAFA analysis

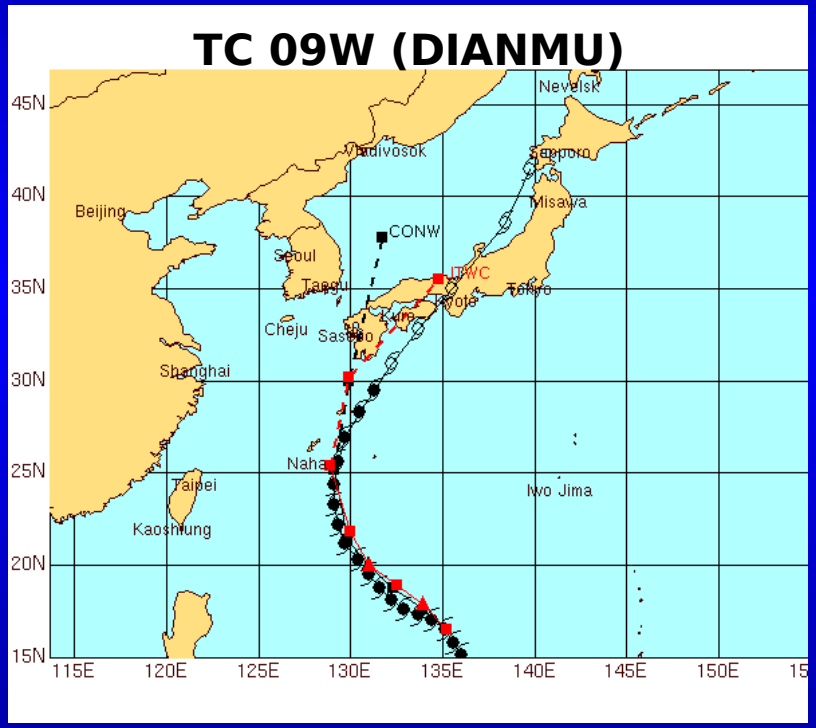
What would your forecast be?



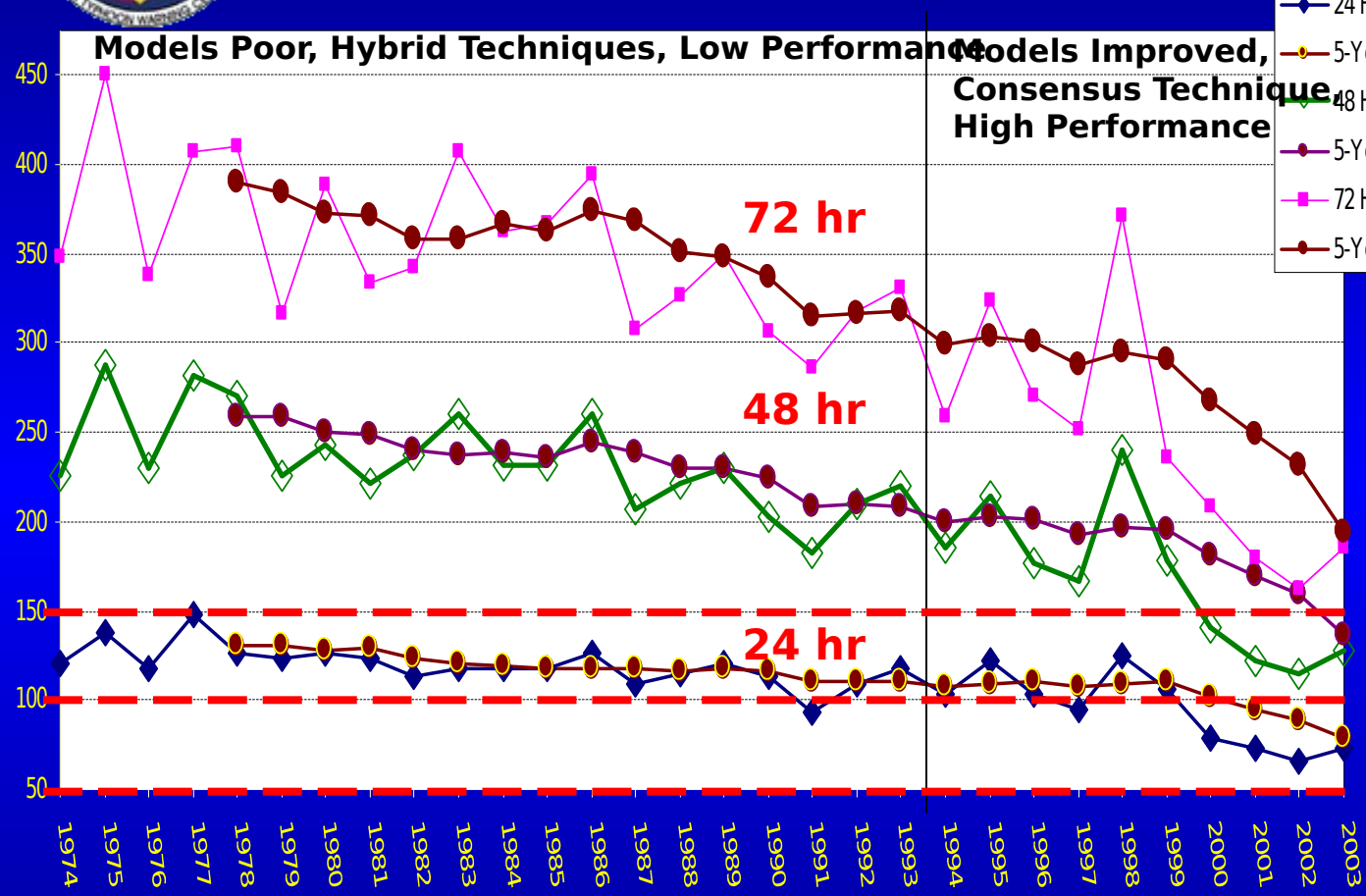


JTWC Forecast

- NOGAPS was recognized to have E-DCI with a low in Yellow Sea and discounted
- Forecast was east of CONW
- Value added to 120 hour TAU



JTWC Position Error Trend



120hr
2000: 325nm
2001: 419nm
2002: 278nm
2003: 297nm
2004: 229nm

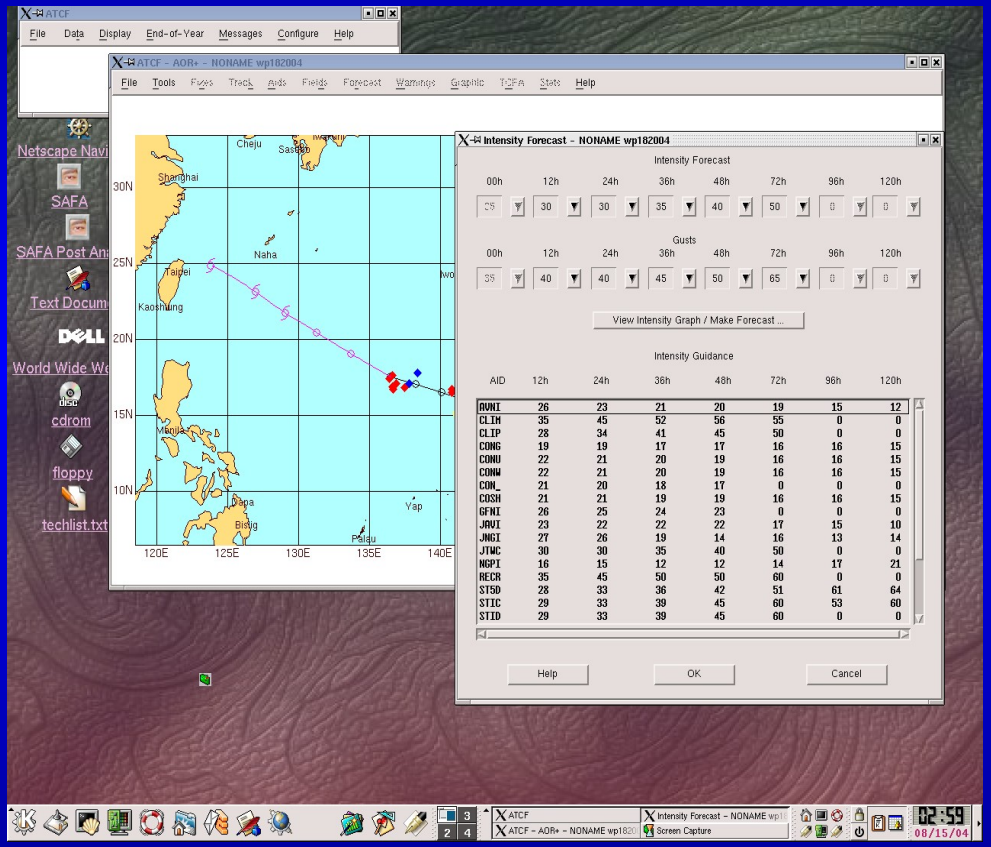
72hr
2000: 209nm
2001: 180nm
2002: 162nm
2003: 185nm
2004: 165nm

48hr
2000: 142nm
2001: 118nm
2002: 115nm
2003: 128nm
2004: 124nm

24hr
2000: 81nm
2001: 70nm
2002: 66nm
2003: 73nm
2004: 69nm

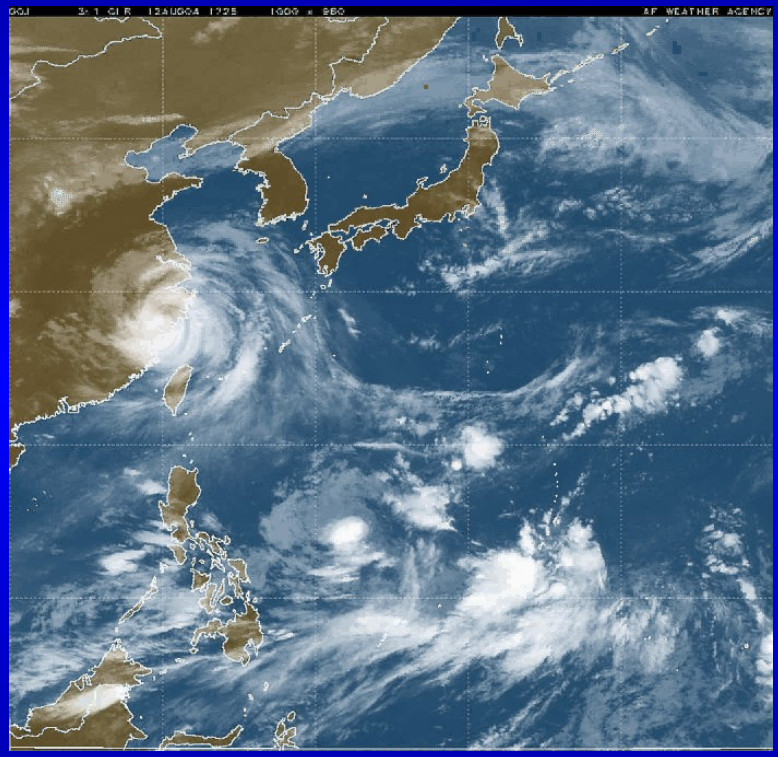
Forecasting Intensity

- Analyzed Upper Air Chart
- University of Wisconsin (UW) CIMSS Product Suite
- SAFA
- Customized Model Fields in WxMap
  - TC Structure
- Statistical Guidance
  - MIT CHIPS
  - CSU CIRA ST5D/STIPS
    - Statistical/Dynamic Model

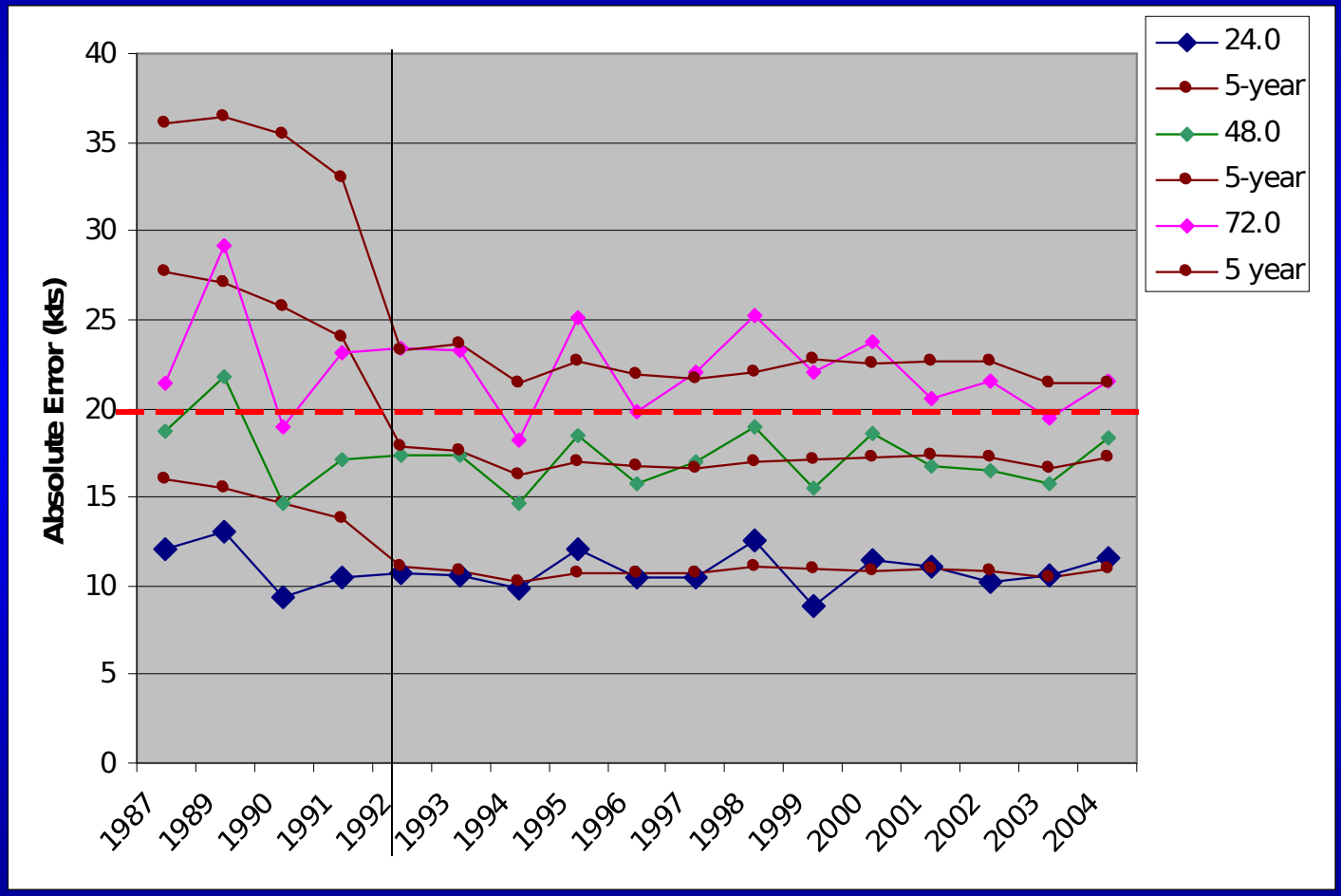


Intensity Tools at JTWC

- Experimental vertical shear TC intensity trend estimate
  - UW-CIMSS
- Consensus Guidance
  - ICON
- Intensity analysis & forecast checklists
- Intensity 1st guess guidance
- Satellite data loop



FORECAST INTENSITY MEAN ABSOLUTE ERRORS



120hr
2003: 19kts
2004: 27kts

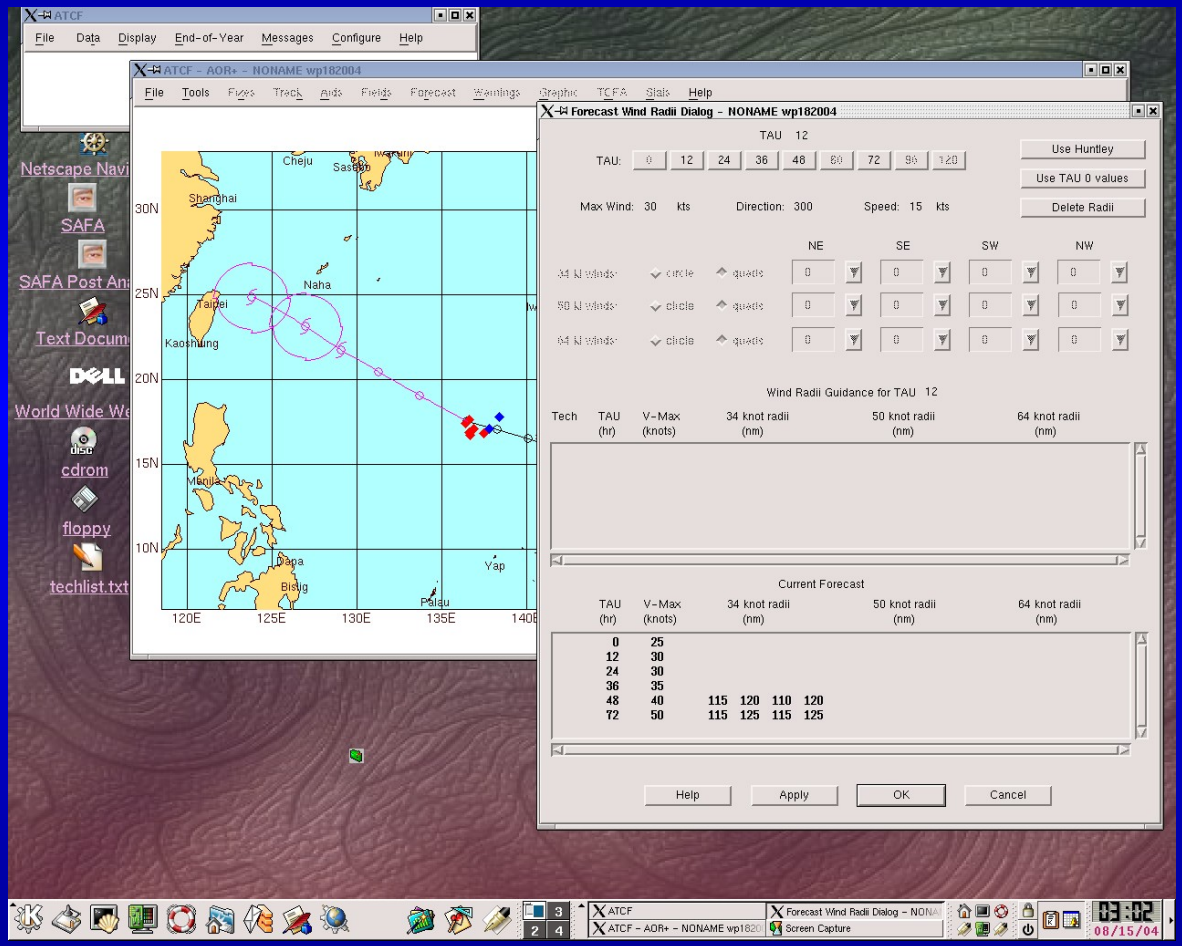
72hr
2000: 24kts
2001: 21kts
2002: 20kts
2003: 20kts
2004: 22kts

48hr
2000: 19kts
2001: 17kts
2002: 16kts
2003: 16kts
2004: 18kts

24hr
2000: 12kts
2001: 11kts
2002: 10kts
2003: 11kts
2004: 12kts

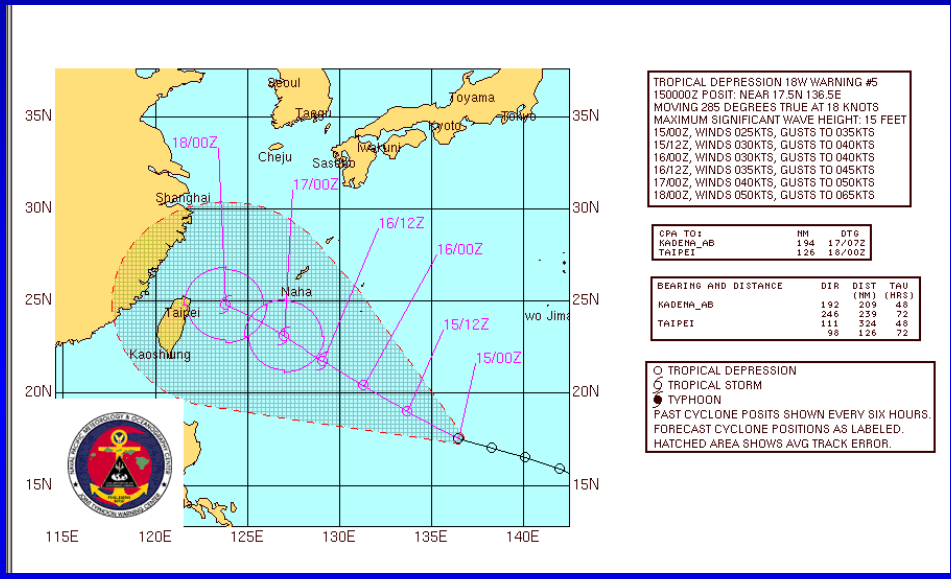
Creating the Wind Radii

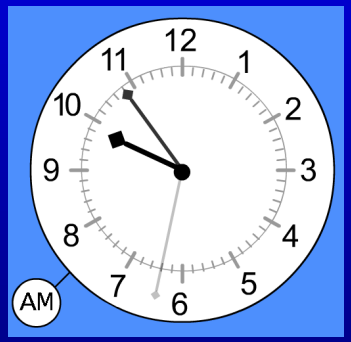
- DCRL
- Quikscat
- Microwave
- Storm motion
- Wx Map
  - TC Structure



Issuing the JTWC Forecast

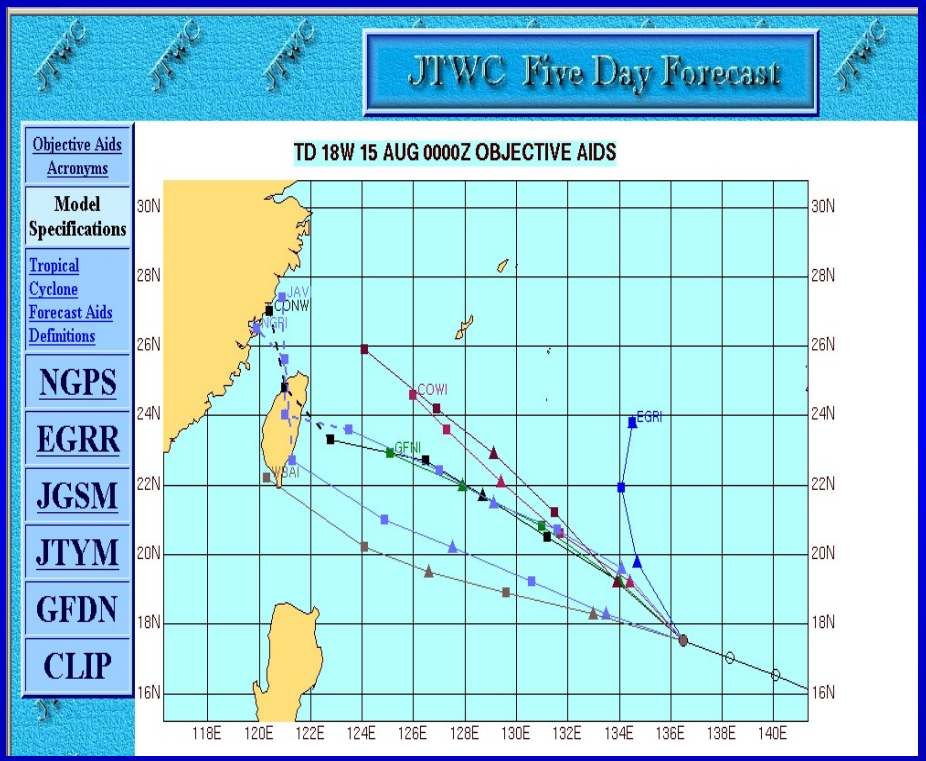
- Prog reasoning to be completed
- TDA posts to DMS and Web Page
- Repeat for Storm #2 and #3
  - Prioritize warning wrt ops impact
- All warnings in customers hands NLT 2.5 hours from synoptic time
  - 1030L
- Compute and post CPA's
- Customer Notification
- Conference Calls





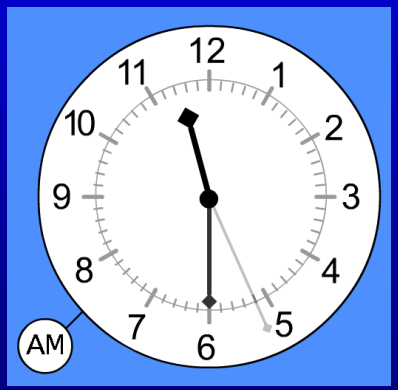
Posting the 5 day Aids

- Available to METOC only
- Time consuming posting process
- Working on a script based upload tool
- Must be pulled from JTWC data server



Conference Call

- Conference calls with customers during high profile WESTPAC cyclones
- Usually when interest is high and phones ringing off the hook



After 1130L….

- MetWatch for new developments
  - Upgrade Significant Weather Advisories as necessary
- Monitor off-time fixes
- New analysis of atmosphere
  - Models, CIMSS, Microwave, Quikscat, Other Agencies
- Prep Prog Reasoning bulletin for second warning cycle
- Maybe….
  - Restroom
  - Lunch

It’s 1400L, start again…..

1200L Perform streamline analyses, look for suspect areas, review old data and previous forecasts, issue sig wx bulletin(s)

1400 L Start 0000 UTC Warning

1630 L Issue 0000 UTC Warning

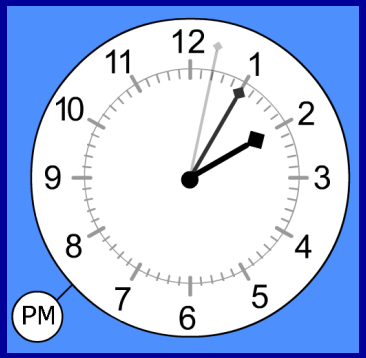
1645L Prog Reasoning

1700L Shift Change

A T C F

Warning Crunch

- Review fixes
- Update BT
- Send Bogus
- Create Consensus
- SAFA Analysis
- Intensity Assessment
- Wind Radii
- Create Warnings
- Issue Warnings
- 5 Day Aids
- Customer Calls

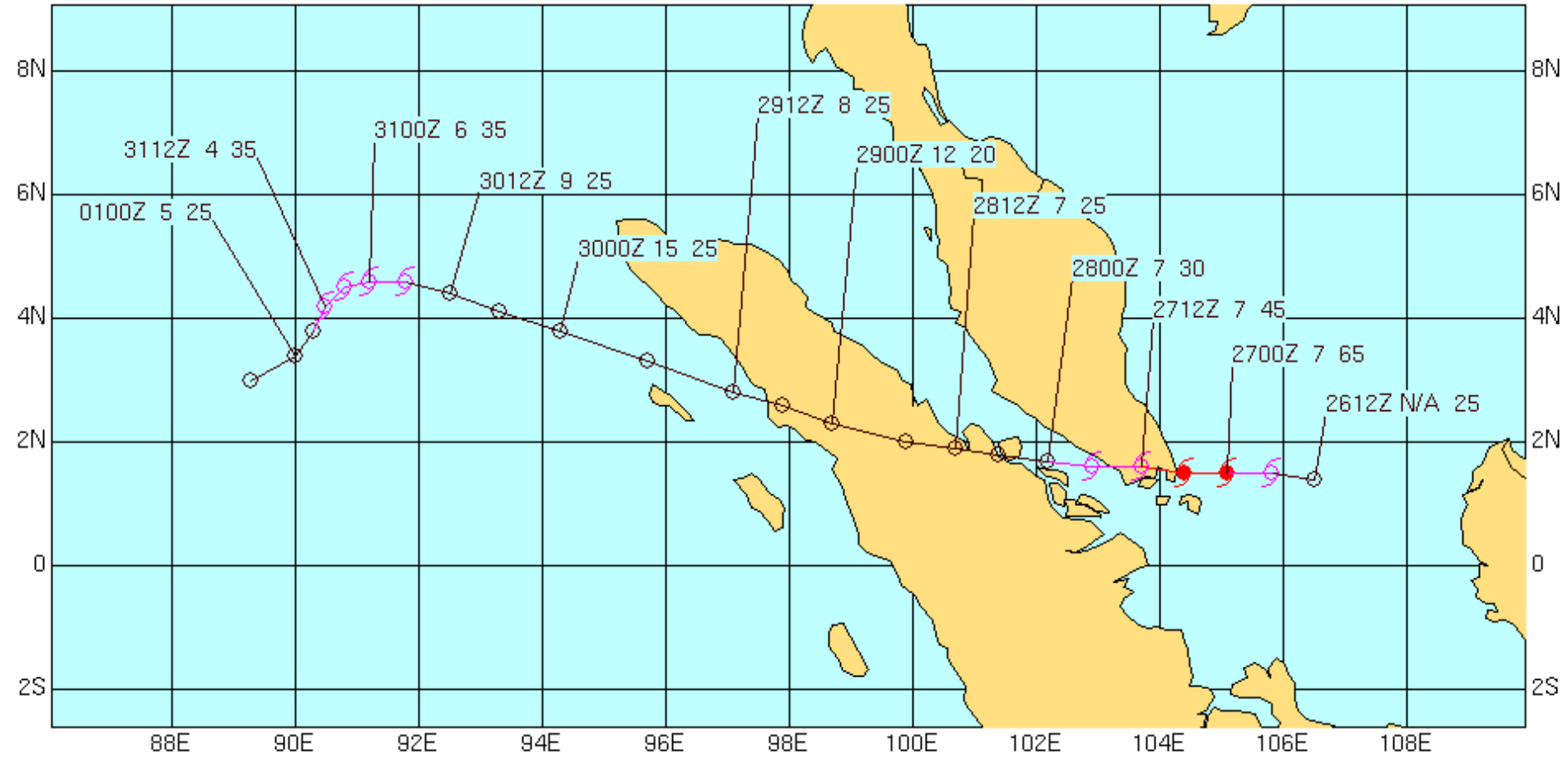


“IF….”

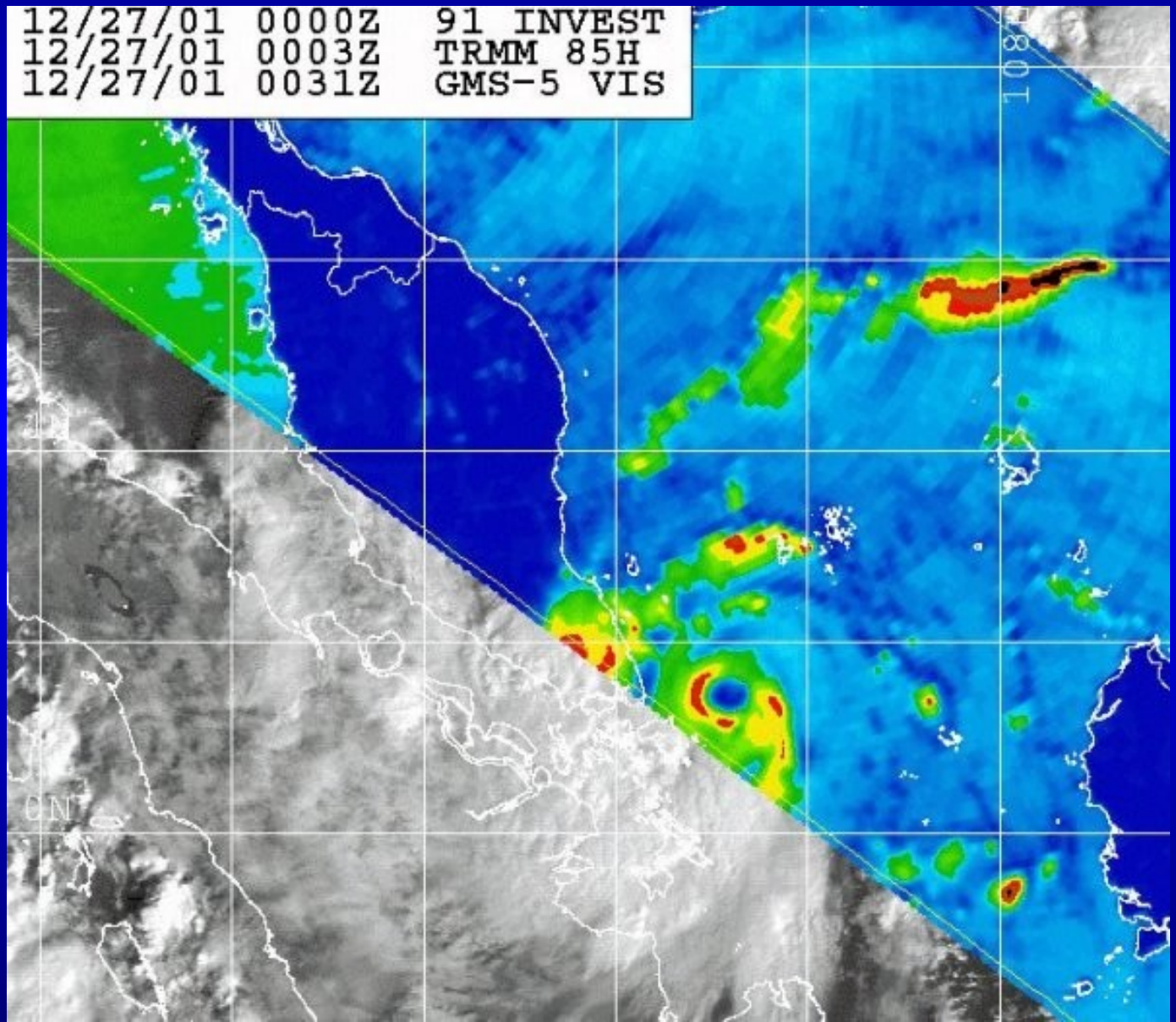
- If all storms were well behaved…..
- “They never…….”

Typhoon 32W (Vamei)
26 Nov – 01 Dec 2001

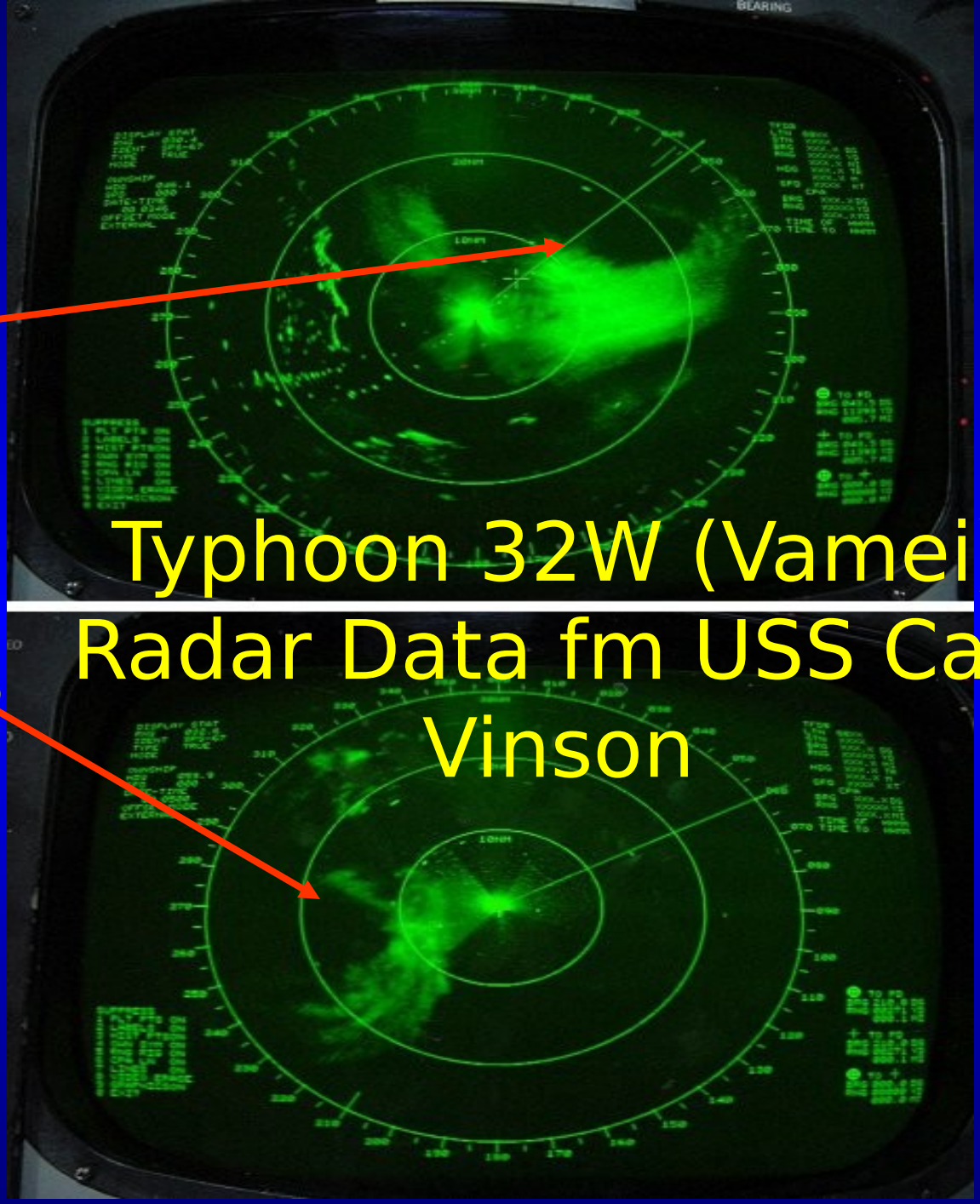
They “”Never” track towards the equator towards an aircraft carrier!



Typhoon 32W (Vamei) Cont'd

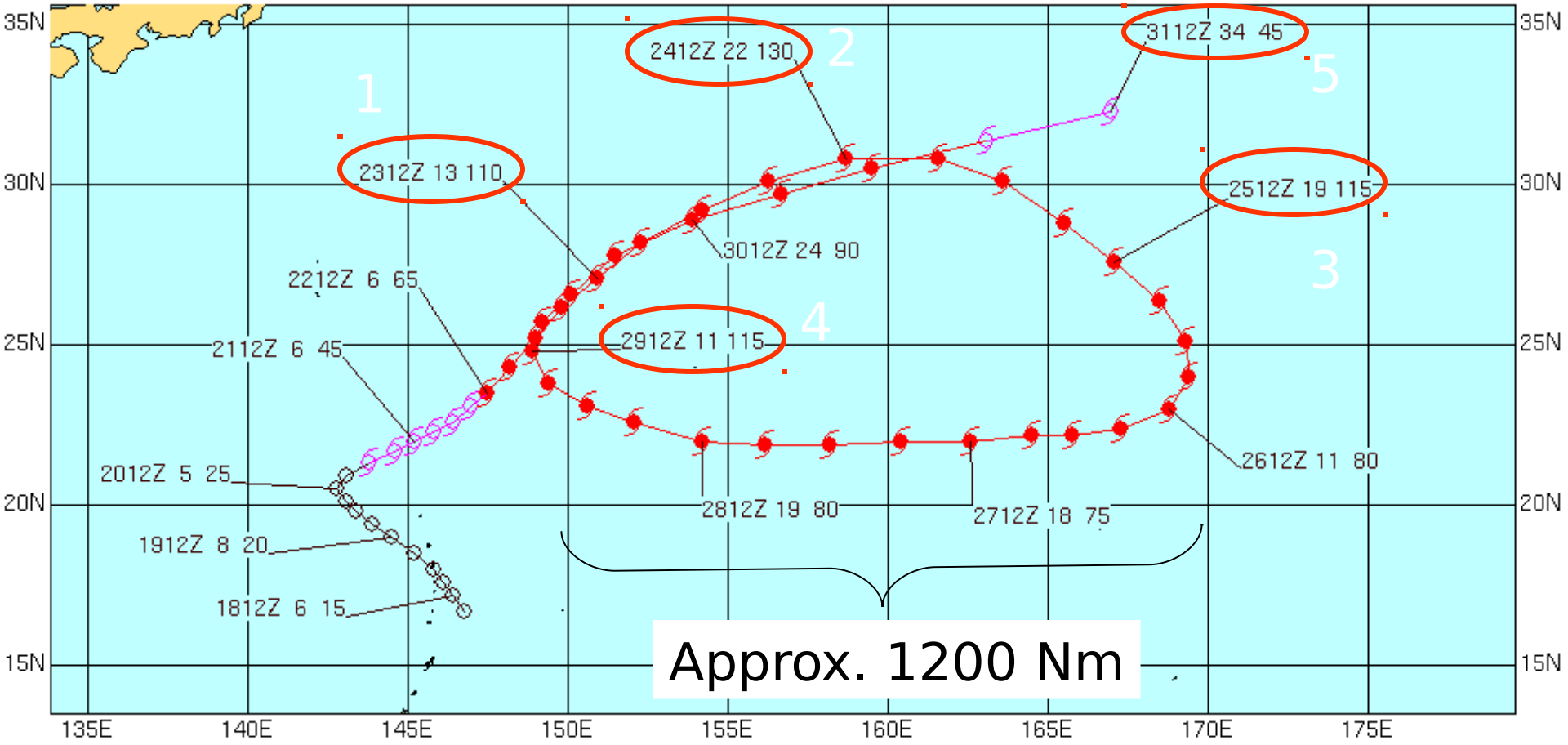


Typhoon 32W (Vamei)
Radar Data fm USS Carl Vinson

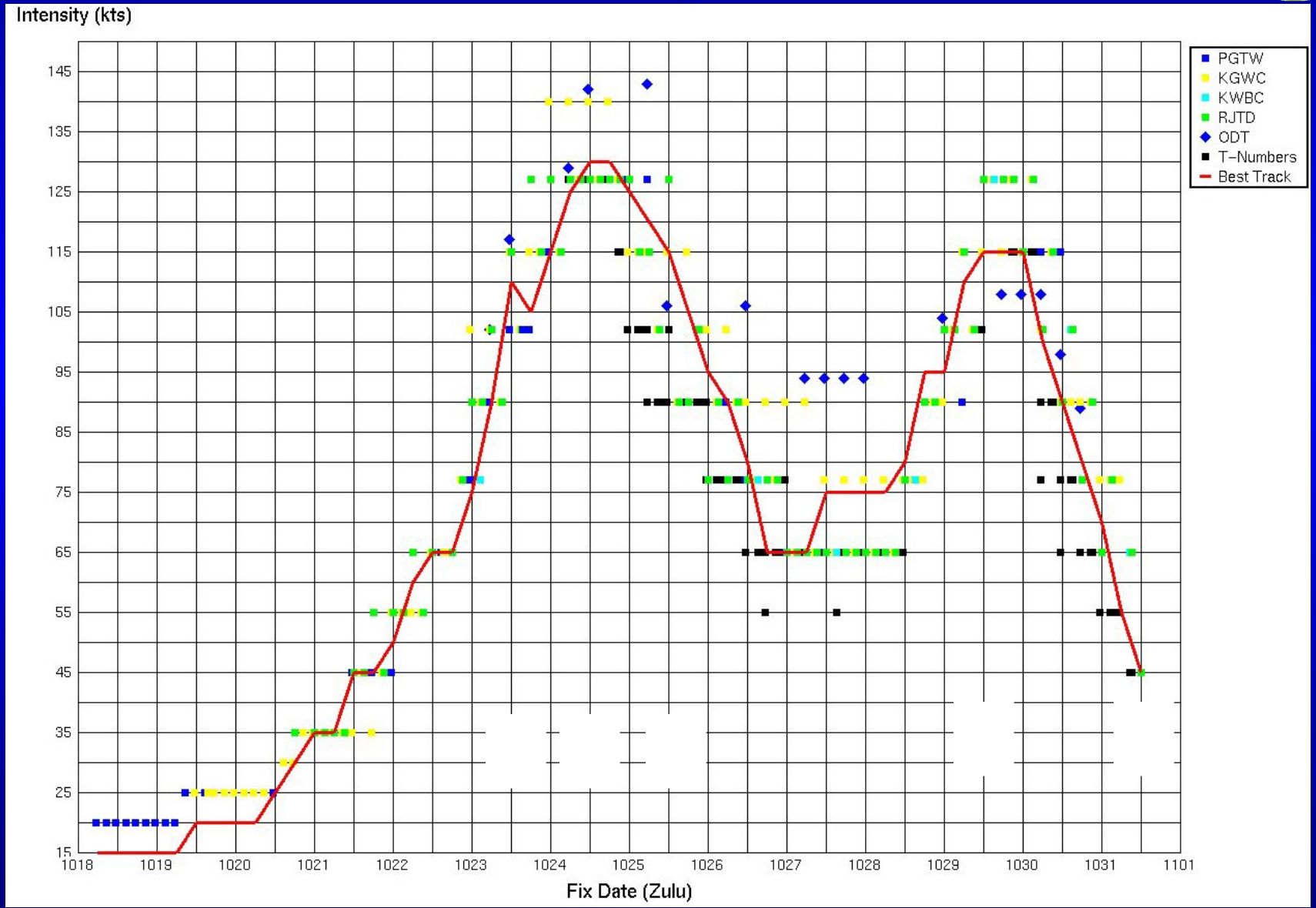


Typhoon 21W (Parma)
18 Oct – 31 Oct 2003

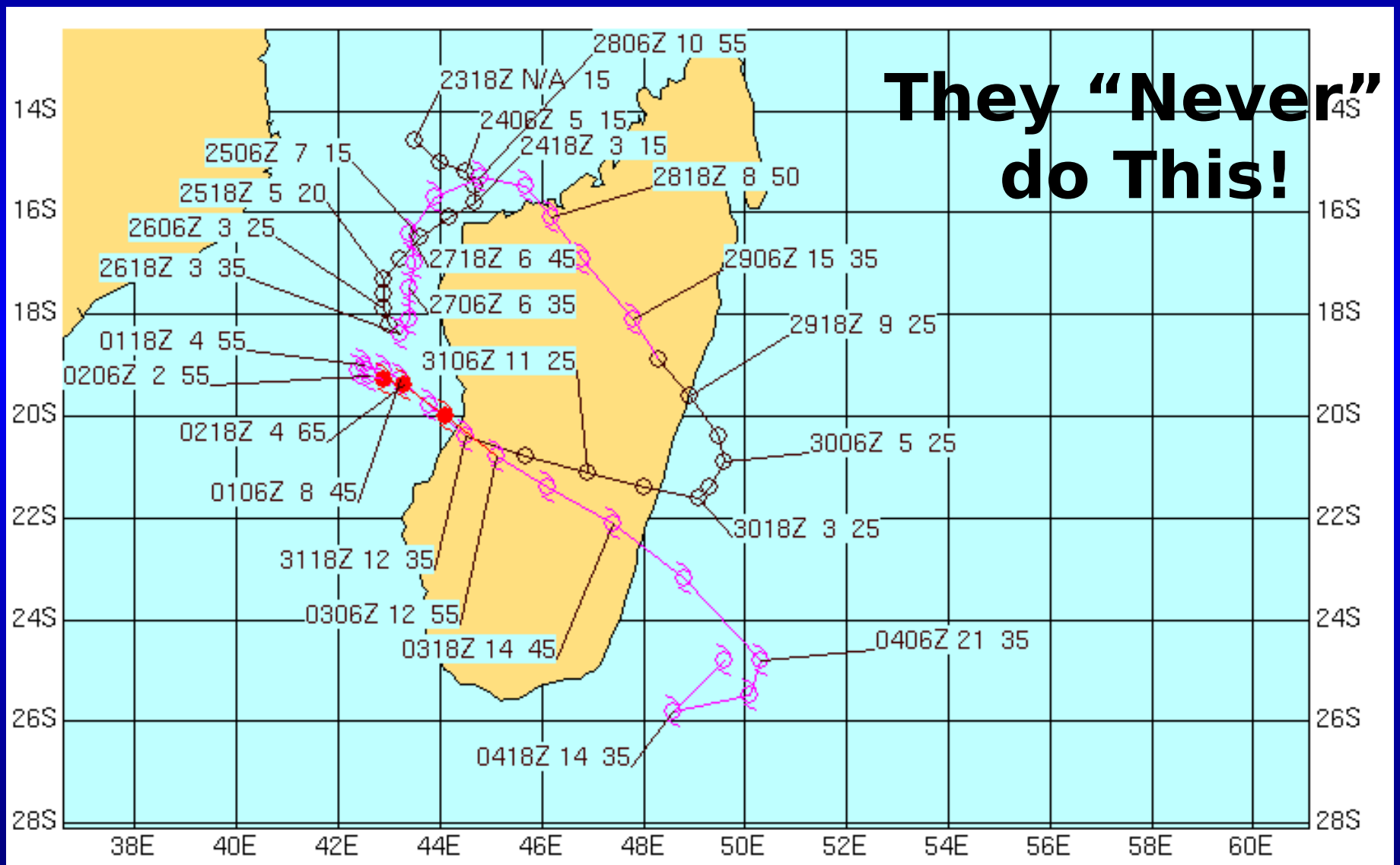
They “Never” do a 1200 nm loop….with a double intensity max!



Typhoon 21W (Parma)
18 Oct – 31 Oct 2003



Tropical Cyclone 09S (Elita)
23 Jan – 05 Feb 2004



At JTWC, You Learn to….

- Never say “Never” Again